Pollution Prevention for Laboratories

Procedural or Policy Change

1. Prepare and follow a waste management reduction policy for your lab.
2. Include pollution prevention in employee training, job descriptions and SOPs.
3. Incorporate manuals, such as the American Chemical Society "Less is Better" or "ACS Waste Management Manual for Lab Personnel" into training.
4. Create incentives for waste reduction.
5. Review procedures regularly for opportunities to reduce or eliminate materials and wastes.
6. When preparing a new protocol, consider its waste streams and strive to reduce or eliminate them. When researching a new or alternative procedure, consider the amount of wastes produced.
7. Polymerize epoxy waste into a safe solid.
8. Neutralize corrosive waters that do not contain metals at the lab bench, if so noted in the SOP for that process.
9. Deactivate highly reactive chemicals in the hood, if so noted in the SOP for that process.

Inventory Controls

1. Centralize purchasing of chemicals through one person in the lab.
2. Submit updated hazardous materials data weekly.
3. Before purchasing a new chemical or chemical product, try to obtain chemicals needed from another lab or activity on Post (FREEBIES program through HITS).
4. Promptly flag all excess usable chemicals to your activity environmental coordinator or the Installation HAZMART for re-issue.
5. Purchase chemicals in the smallest quantities needed.
6. Follow first-in, first-out procedures.
7. When testing experimental products for private companies, limit donations to the amount needed for research. Return unused samples to company or vendor.
8. Limit chemical inventory in lab to a one-week supply. Obtain chemicals and chemical products only if you will use them within 6 months or before they will expire.
9. Dispose of items containing polychlorinated biphenyls according to RCRA requirements (AECs will assist with this).

Process or Equipment Change

1. Consider the quantity and type of wastes produced when purchasing new equipment. Purchase equipment that produces less waste.
2. Use a metal oven thermometer instead of a mercury thermometer in ovens.
3. Use a digital thermometer where possible.
4. Substitute red liquid (alcohol) thermometers (range up to 150 degrees C) for mercury thermometers where possible.
5. Evaluate laboratory procedures for opportunities for the use of less hazardous reagents.
6. Consider using ozone treatment for parts cleaning.
7. Use digital photography and pixel ray whenever possible. If traditional, wet-processing photography and x-ray remain the only viable options, ensure that all spent fixer is processed for silver recovery.
8. Use HVLP paint guns, Laser Touch and MiniMax Cleaner for paint equipment.
9. Use digitized or automated equipment whenever possible to eliminate wastes from inaccuracy and error.
10. Scale down experiments producing hazardous waste wherever possible.
11. When solvent is used for cleaning purposes, use spent solvent for initial cleaning and fresh solvent for final cleaning.
12. Perform work in batches.

Material Substitution

1. Use the least hazardous cleaning method for glassware. Use hot water and detergents, such as Alconox, Miro, or RBS35 on dirty equipment before using KOH/ethanol bath, acid bath or No Chromix where possible.
2. Eliminate the use of chromic acid all together where possible.
3. Do not use uranium and thorium compounds without prior approval from your organization's Radiation Protection Officer.
4. Review the use of highly toxic, reactive, carcinogenic or mutagenic materials to determine if safer alternatives are feasible.
5. Avoid the use of reagents containing: barium arsenic, cadmium, chromium, lead, mercury, selenium, and silver.
6. Seek alternatives to phenol extractions (e.g. small scale plasmid prep using no phenol may be found in Biotechnica, Vol. 9, No. 6, pp. 676-678).
7. Substitute stearic acid for acetamide in phase change and freezing point depression.
8. Substitute ethanol for formaldehyde in biological specimen storage.
9. Substitute limonene based extracts for xylene for histology uses.
10. Consider using solid phase extractions for organics.
11. Avoid the use of hazardous solvents. Try to find non-flammable, biodegradable substitutes. If hazardous solvents must be used, investigate redistillation to minimize disposal requirements.
12. Avoid the use of oxidizers.

Material Reuse

1. Examine your waste/excess chemicals to determine if there are other uses in your lab, neighboring labs, departments or other APG activities that might be able to use them.
2. Purchase compressed gas cylinders, including lecture bottles, only from manufacturers who will accept the empty cylinders back.
3. When solvent is required for cleaning purposes, use spent solvent for initial cleaning and fresh solvent for final cleaning.
4. Reuse acid mixtures for electropolishing.
5. Store and reuse developer in photo labs.
6. Evaluate other wastes for reclamation in labs. Discuss this with your AEC during your SAS inspections.

Process Efficiency

1. When cleaning substrates or other materials by dipping, process multiple items at once.
2. Use smallest possible container for dipping or for holding photographic chemicals.
3. Use best geometry of substrate carriers to conserve chemicals.
4. Scale down experiments producing hazardous waste wherever possible (quarter scale testing, microchemistry).
5. Use pre-weighed or pre-measured reagent packets for labs where waste is high.
6. Include waste management as port of the testing protocols.